Original Article

Frequency of Sign and Symptoms of Asthma in Schoolchildren in the Yaqui Valley

Frecuencia de signos y síntomas de asma en escolares del Valle del Yaqui

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Summary

Objective: To determine the frequency of signs and symptoms of asthma and nutritional status in school children attending a Primary Care Level Unit in Ciudad Obregon, Mexico. **Methods:** Cross-sectional analytical study, conducted between January and December 2020. The sample included 425 schoolchildren who met the selection criteria. Asthma symptoms were detected through the Asthma Diagnostic Questionnaire for Epidemiological Studies, Body Mass Index assessed nutritional status. The rest of the variables were obtained from a structured interview. For bivariate analysis odds ratio and Pearson's χ^2 with 95% confidence intervals ($p<0.05$) were used. **Results:** 53% were female and 47% male, of the 425 patients. The most frequent signs and symptoms of asthma were recurrent catarrh and wheezing. According to the applied questionnaire, 29% of patients met asthma criteria. Malnutrition was found in 38% of the participants. **Conclusions:** The frequency of asthma symptoms and child malnutrition were high in the study population compared to other geographical areas of the country.

Keywords: Asthma; Pediatric Obesity; Signs and Symptoms, Respiratory; Pediatrics; Nutrition Assessment

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Resumen

Objetivo: determinar la frecuencia de signos y síntomas de asma y el estado nutricional en escolares de una unidad de atención primaria en Ciudad Obregón, México. **Métodos:** estudio transversal analítico, se realizó entre enero y diciembre de 2020. La muestra fue de 425 escolares que cumplieron los criterios de selección. Los síntomas de asma se detectaron a través del cuestionario Diagnóstico de Asma para Estudios Epidemiológicos, el estado nutricional se evaluó mediante el índice de masa corporal. El resto de las variables se obtuvo a partir de una entrevista estructurada. Para el análisis bivariado se utilizó razón de momios y χ^2 de Pearson con intervalos de confianza de 95% ($p<0.05$). **Resultados:** de los 425 pacientes, 53% era de sexo femenino y 47%, masculino. Los signos y síntomas de asma más frecuentes fueron cuadros recurrentes de catarro y sibilancias. 29% de los pacientes cumplía con criterios de asma, según el cuestionario aplicado. Se encontró malnutrición en 38% de los participantes. **Conclusiones:** la frecuencia de síntomas de asma y malnutrición infantil fueron elevadas para la población de estudio, en comparación con otras zonas geográficas del país.

Palabras clave: asma, obesidad infantil, signos y síntomas respiratorios, pediatría, evaluación nutricional

Introduction

Asthma is the most common chronic airway disease in pediatrics,[1] with variable symptomatology, but the classic manifestations are wheezing, dyspnea, coughing, chest tightness, bronchial hyper-responsiveness and variable airflow obstruction.[2-4] The pathophysiology remains under study, but there is evidence of a complex interaction between genetic and environmental factors;[5] although genetics is important in its development, environmental factors such as climate change, pollution, changes in the home environment and industrialization may account for variations in the prevalence of this disease.[6]

Its worldwide frequency varies from 235 to 300 million people.[4] In Latin America, according to The International Study of Asthma and Allergies in Childhood (ISAAC), prevalence is estimated at 17%,[7] with variations according to age and region; in children, Brazil reports 13%;[8] Argentina, 10-18%;[9] Bolivia, 14%;[9] Chile, 11-21%;[10] Colombia, 9-17%;[11] Venezuela, 15-20% and Peru, 20%. [9] In Mexico, the prevalence of asthma ranges between 1 and 15%.[9] The prevalence of asthma is based on clinical diagnosis and the report of questionnaires created to evaluate symptoms. These instruments are auxiliary tools in the diagnosis and follow-up of patients; the most widely used is the ISAAC, which evaluates the frequency of symptoms of asthma, atopic dermatitis and allergic rhinitis in children from 6 to 7 years and adolescents from 13 to 14 years.[12]

In Mexico, Mancilla-Hernández et al.[13] created and validated the Asthma Diagnostic Questionnaire for Epidemiological Studies to determine the prevalence of asthma in Mexican children, which has been applied in different regions of the country. According to this questionnaire, the prevalence of the following cities is: Tulancingo 17%; Puebla, 14%; Cancun, 14%[14] Cuernavaca, 11.9% and Tlaxcala, 7%;[15] the average is 12.7%. The use of the questionnaire in different regions of the country allows a more precise evaluation of the frequency of asthma symptoms considering the national context, and also offers a more comprehensive view of the history, symptomatology and evolution of the patients. Therefore, the general objective of the present study was to determine the frequency of asthma signs and symptoms, as well as nutritional status in children from 6 to 12 years attending a Primary Care Level Unit in Ciudad Obregon, Mexico.

Methods

A cross-sectional, analytical observational study conducted in the Yaqui Valley, in Ciudad Obregon, Mexico, between January and December 2020. The research was carried out at the Family Medicine Unit No. 1 of the Mexican Institute of Social Security (IMSS); a primary care level unit and main health care center of the region. School-age patients (6-12 years) who agreed to participate in the study by informed assent and parental informed consent were included. Children with pulmonary disease and an established diagnosis of asthma were excluded from the study; patients were recruited in the waiting rooms of the family medicine outpatient clinic.

The collection of variables was done with a standardized data sheet; the variables to be studied were: age, sex, nutritional status, the Quetelet's index (BMI=weight/height^2) was used to calculate the body mass index (BMI) participants were weighed and measured on a scale with a Transcell Technology model TI-540-SL stadiometer, then the patient's percentile was calculated based on the BMI for age according to the tables of the Center for Disease Control and Prevention (CDC), whoever exceeded the 85th and 95th percentile, was considered overweight and obese, respectively.

The presence of asthma symptoms was determined through the Asthma Diagnostic Questionnaire for Epidemiological Studies, validated in 2014, with a Cronbach's alpha of 0.7, designed for children and adults; it consists of nine items, each question represents a sign, symptom or characteristic antecedent of the disease and establishes the diagnosis of asthma with a score greater than or equal to 0. 75.[13] The positive result of the instrument is not sufficient for a definitive diagnosis of asthma, but it aims towards this possibility and serves as a starting point to initiate a complete study protocol. For the purposes of the study, the diagnosis of asthma was operationalized with a score ≥0.75 on the questionnaire.

For statistical analysis, frequencies and percentages for qualitative variables were used; for quantitative variables average and interquartile range (IQR) were used. The normality test was performed using the Kolmogorov-Smirnov test. Pearson's χ^2 analysis was performed to test for differences in categorical variables and the odds ratio was used to calculate risk. The results were evaluated at a 95% confidence interval; a $p<0.05$ value was considered statistically significant. The SPSS v. 20 program was used for data analysis. The study was approved by the Local Ethics and Health Research Committee number 2603; with registration number R-2019-2603-102. The parents of the children signed the informed consent and the participants the informed assent.

Results

There was a predominance of the female gender (53% girls vs. 47% boys) in the analyzed sample. The baseline characteristics are specified in Table 1.

The average age was 9 years (IQR 3). The frequency of asthma signs, symptoms and background is shown in Table 2.

Among the 425 patients, 122 cases of asthma were found, corresponding to 29%, according to the questionnaire result. In nutritional status, 13 children were underweight (3%), 263 were normal weight (62%), 117 were overweight (27%) and 32 were obese (8%). The body mass index average was 17.35 kg/m^2 (IQR 4). Malnutrition in the population reached 38%, with a tendency towards overweight and obesity. Figures 1 and 2 show the distribution of asthma according to nutritional status and age.

In the group of patients with a positive score for asthma (≥0.75), 53% were female and had an adequate nutri-

Table 1. Baseline Characteristics of the Participants

Characteristic (n=425)	n (%)	95% IC
Age - years	9 (3)a	--
BMI - kg/m^2	17.3 (4) a	--
Sex		
Men	198 (47)	(42-51)
Women	227 (53)	(48-57)
Nutritional status		
Underweight	13 (3)	(1-4)
Normal weight	263 (62)	(57-66)
Overweight	117 (27)	(22-31)
Obesity	32 (8)	(5-10)
Asthma[b]		
Yes	122 (29)	(24-33)
No	303 (71)	(66-75)

Notes: a=median (interquartile range),
b (≥0.75 points in questionary),
BMI=body mass index.

Table 2. Frequency of Asthma Signs, Symptoms and Background

Questionnaire items (n=425)	n (%)	95% IC
Family history of allergy	185 (44)	(39-48)
Recurrent catarrh	178 (42)	(37-46)
Recurrent wheezing	147 (35)	(30-39)
Cough increases with the cold	136 (32)	(27-36)
Recurrent cough	109 (26)	(21-30)
Night cough	90 (21)	(17-24)
Breathing difficulty	89 (21)	(17-24)
Cough increases with exercise	87 (21)	(17-24)
Chest tightness	52 (12)	(8-15)

Figure 1. Frequency of Asthma and Nutritional Status

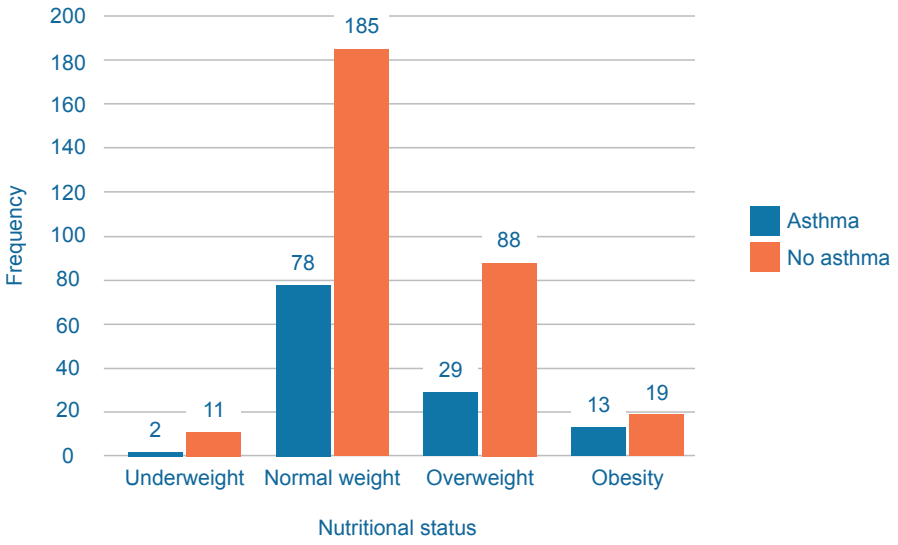
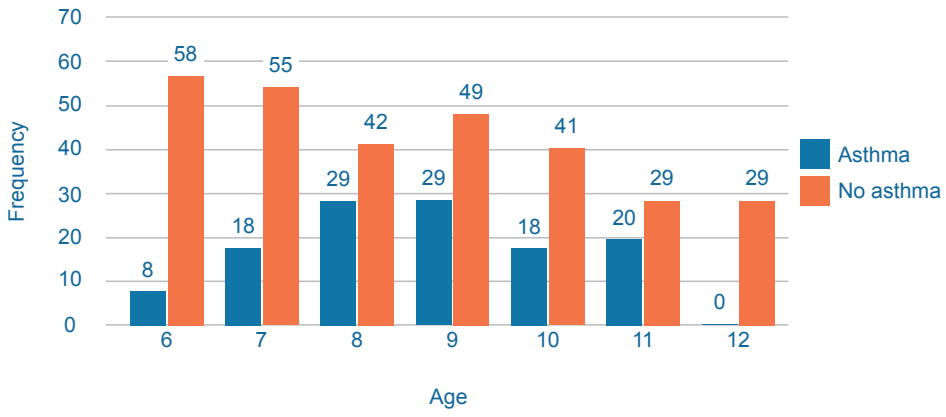


Figure 2. Frequency of Asthma and its Distribution According to Age



tional status (64%). In this group, the most important signs, symptoms and background were: wheezing 98%, allergy family background 85%, recurrent catarrh 75% and respiratory distress 71%. The results of the bivariate analysis are shown in Table 3.

Discussion

The most important finding of this study was the high proportion of signs and symptoms of asthma in the school children; the most frequent symptom in all participants was recurrent catarrh (42%). In patients who met asthma criteria by the questionnaire, the most frequent sign was wheezing (98%); these results agree with Mancilla-Hernández et al.[14] who found that the most frequent sign was wheezing, in a multicenter study developed in Mexico, a risk indicator for the epidemiological diagnosis of asthma, another consistent finding with our study. The high frequency of asthma signs and symptoms in the present study can be explained by the local geographic characteristics; this region is known as the Yaqui Valley and is an agricultural region with multiple ecosystems that host a great diversity of flora and fauna with an enormous allergenic load; in addition, the climate is hot and dry,[16] the relative humidity is, on average, 45% with an annual rainfall of 450 mm.[17]

In the frequency of asthma, our results are much higher than the figures found in central and southern Mexico and even the national prevalence; in the cities of Cuernavaca,[15] Puebla, Tulancingo, and Tlaxcala,[14] located in the center of the country, it was found an average prevalence of 12. 4%; in Cancun, located in the southern, there is a prevalence of 14%;[14] there are few studies using the Diagnostic Asthma Questionnaire for

Table 3. Characteristics Associated with Asthma Diagnosis

Asthma				
Characteristic	**Yes (n=122)**	**No (n=303)**	**OR (95% CI)**	**p**
Age[a]	9 (2)	8 (3)	--	0.15[b]
BMI[a]	17.1 (4.9)	17.3 (4.1)	--	0.39[b]
Sex[c]				
Men	58 (48)	140 (46)	1.0 (0.6-1.6)	0.80[d]
Women	64 (52)	163 (54)		
Family history of allergyc[c]				
Yes	104 (85)	81 (27)	15.8 (9.0-27.7)	<0.001[d]
No	18 (15)	222 (73)		
Recurrent cough[c]				
Yes	80 (66)	29 (10)	17.9 (10.5-30.7)	<0.001[d]
No	42 (34)	274 (90)		
Cough increases with the cold[c]				
Yes	82 (67)	54 (18)	9.4 (5.8-15.2)	<0.001[d]
No	40 (33)	249 (82)		
Cough increases with the exercise[c]				
Yes	71 (58)	16 (5)	24.9 (13.4-46.3)	<0.001[d]
No	51 (42)	287 (95)		
Night cough[c]				
Yes	60 (49)	30 (10)	8.8 (5.2-14.7)	<0.001[d]
No	62 (51)	273 (90)		
Recurrent wheezing[c]				
Yes	120 (98)	27 (9)	613 (143-2620)	<0.001[d]
No	2 (2)	276 (91)		
Breathing difficulty[c]				
Yes	86 (71)	3 (1)	238 (71-794)	<0.001[d]
No	36 (29)	300 (99)		
Chest tightness[c]				
Yes	52 (43)	1 (1)	224 (30-1650)	<0.001[d]
No	70 (57)	302 (99)		
Recurrent catarrh[c]				
Yes	92 (75)	86 (28)	7.7 (4.7-12.5)	<0.001[d]
No	30 (25)	217 (72)		

OR=odds ratio, a=median (interquartile range),
b=Mann-Whitney U. C=frequency (percentage), d=Pearson χ^2.

Epidemiological Studies, for this reason, comparisons with the same instrument are limited. When comparing our findings with studies using the ISAAC questionnaire, important differences can be appreciated. Mallol et al.[7] found a prevalence of asthma symptoms in Latin America of up to 18.9%, much lower than that reported in this study; in another investigation, the same author found substantial variations in Mexico ranging from 1.9 to 14.9%, with an average of 6.9%; the results presented here showed a higher frequency of symptoms.[9]

Symptoms associated with asthma can be risk indicators for presenting the disease; although the symptoms are part of the disease and have a variable association, the strength of this association allows us to suspect the pathology with the presence of a cardinal symptom[14]. In this regard, our study revealed that the symptoms with the strongest association were wheezing, shortness of breath and chest tightness, which is consistent with other studies conducted in Mexico.[13-15]

Overweight (27%), obesity (8%) and underweight (3%) also deserve special attention in the obtained results. Malnutrition shows alarming figures, more than one third of the studied children present weight alterations. These results are similar to those shown in the National Health and Nutrition Survey 2018, which shows that overweight and obesity are present in 36% of children from five to eleven years.[18] In Latin America, the picture is not different, the figures of overweight and obesity in school children vary from 14% to 38% in countries such as Brazil, Colombia, Chile and Mexico,[19] the highest prevalence is found in Chile (38%) and the lowest, in Colombia (14%); the figures in this re-

gion of the world are worrying and agree with our study. Although comprehensive management of patients with weight alterations has been initiated through the department of nutrition, family medicine, and pediatrics, it is necessary to focus efforts on preventive measures mainly in the family and school environment. In recent years there has been a significant increase in the prevalence of childhood obesity and asthma; some studies indicate that obesity increases the risk and morbidity of asthma in early stages of life, especially before the age of seven years.[20] The studied population is above this age range and this condition could explain why a third of the patients with a positive questionnaire for asthma are overweight or obese, although the association did not show significant differences between groups.

Among the strengths of the study, it stands out as the first of its kind in the Yaqui Valley, a multifaceted population in constant evolution and exposed to multiple risk factors for the development of allergic diseases. Another important point is the early evaluation of patients with positive results for asthma and weight alterations, where an evaluation protocol was initiated by family medicine, nutrition and pediatrics, which translates into an integral follow-up to plan interventions and timely detections in this age group. The weaknesses of the study lie in the number of patients, since it was limited to only one family medicine clinic. Compared to other national studies, a significant difference in the sample is found.

Conclusions

Asthma symptoms are frequent and often isolated and subtle, which makes it difficult for the physician to recognize them. The use of the Asthma Diagnostic Questionnaire for Epidemiological Studies allows the integration of the clinical picture shown by patients and offers an approximation to the presence of asthma, which is superior to what is offered by questionnaires based on a single question to guide the diagnosis. The presence of a cardinal symptom such as those detected in this research can be used to initiate studies by means of an intentional search in pediatric patients.

A look towards this area of the country is required to carry out more extensive studies to clarify the picture of allergic respiratory diseases in this region.

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